

NON-PUBLIC?: N
ACCESSION #: 9501050235
LICENSEE EVENT REPORT (LER)

FACILITY NAME: COMANCHE PEAK-UNIT 1 PAGE: 1 OF 8

DOCKET NUMBER: 05000445

TITLE: TURBINE TRIP/REACTOR TRIP DUE TO LOW COOLING WATER
STATOR
FLOW INDICATION
EVENT DATE: 11/29/94 LER #: 94-006-00 REPORT DATE: 12/29/94

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR
SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: W. G. Guldemon, System Engineering TELEPHONE: (817) 897-8739
Manager

COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: No

ABSTRACT:

At 9:21 p.m., CST November 29, 1994, an indicated low flow condition on cooling water to the Main Generator Stator caused a Turbine/Reactor trip. There was no actual loss of stator flow. TU Electric believes that the trip was caused by a sensing line hydraulic anomaly, most likely gas bubbles. Immediate actions were to change the negative slope of the sensing lines to a positive slope to prevent gas accumulation. Corrective actions were to schedule a design modification, which will install separate sensing lines in the primary water flow stator circuit and will install alarms to warn the operators of impending problems with primary water tank level and temperature.

END OF ABSTRACT

I. DESCRIPTION OF THE REPORTABLE EVENT

A. REPORTABLE EVENT CLASSIFICATION

Any event or condition that results in a manual or automatic actuation of any Engineered Safety Feature (ESF), including the Reactor Protection System (RPS)(EIS:(JC)).

B. PLANT OPERATING CONDITIONS PRIOR TO THE EVENT

On November 29, 1994, Comanche Peak Steam Electric Station (CPSES) Unit 1 was in Mode 1, Power Operation, with reactor power at 100 percent.

C. STATUS OF STRUCTURES, SYSTEMS, OR COMPONENTS THAT WERE INOPERABLE AT THE START OF THE EVENT AND THAT CONTRIBUTED TO THE EVENT

Not applicable. There were no inoperable structures, systems or components that contributed to this event.

D. NARRATIVE SUMMARY OF THE EVENT, INCLUDING DATES AND APPROXIMATE TIMES

At 9:20 p.m. CST on November 29, 1994, CPSES Unit 1 was at 100 percent reactor power when the first out annunciator panel indicated that the reactor had tripped as a result of a turbine trip. Control Room personnel (utility, licensed) responded in accordance with emergency operating procedures. All systems functioned as required; no abnormal responses were observed by station personnel.

An event or condition that results in an automatic or manual actuation of any ESF, including the RPS, is reportable within 4 hours pursuant to 10CFR50.72(b)(2)(ii). At 11:45 p.m. CST on November 29, 1994, the Nuclear Regulatory Commission Operations Center was notified of the event via the Emergency Notification System.

E. THE METHOD OF DISCOVERY OF EACH COMPONENT OR SYSTEM FAILURE, OR PROCEDURAL OR PERSONNEL ERROR

The Control Room personnel (utility, licensed) were alerted by a Generator Primary Water System failure alarm which was coincident with the reactor trip first out annunciator. The cooling water for the Generator at CPSES is known as Generator primary water by the manufacturer.

TEXT PAGE 3 OF 8

II. COMPONENT OR SYSTEM FAILURES

A. FAILURE MODE, MECHANISM, AND EFFECT OF EACH FAILED COMPONENT

Not applicable. There were no component failures identified which were associated with this event.

B. DURATION OF SAFETY SYSTEM TRAIN INOPERABILITY

Not applicable. No safety trains were inoperable as a result of this event.

C. SAFETY CONSEQUENCES AND IMPLICATIONS OF THE EVENT

Loss of stator cooling flow to the generator will result in a Turbine Generator trip. This is a secondary side transient enveloped within the Turbine Generator design and the Plant Accident Analysis outlined in the CPSES Final Safety Analysis Report (FSAR) Section 15.2.3.

TU Electric has concluded that this transient did not affect the health or safety of the public and did not adversely affect the safe operation of CPSES Unit 1.

III. CAUSE OF THE EVENT

While a precise cause for the indicted low stator primary water flow could not be conclusively determined, the trip is believed to have occurred as a result of a hydraulic anomaly leading to the generation of a trip signal.

IV. CORRECTIVE ACTION

The automatic trip which occurred on November 29, 1994, was consistent with the indicated low flow condition. In order to determine the cause of the low flow indication a troubleshooting effort was undertaken based on three postulated conditions: 1) An

actual low flow condition occurred, 2) A low flow condition was indicated as a result of some hydraulic anomaly, but an actual low flow condition did not occur; and 3) A low flow condition was indicated and actuation occurred because of an electronic problem in the flow sensing or signal processing circuitry. For each of these postulated conditions a set of parameters was selected and examined to confirm or deny

TEXT PAGE 4 OF 8

the condition, as follows:

1) Actual Low Flow Condition

- a. Inlet throttle valve failure by stem/disk separation or stem failure
- b. Primary water pump failure
- c. Flow blockage of the stator cooling circuit
- d. Loss of fluid inventory

2) Indicated Low Flow Condition As a Result of Hydraulic Anomalies

- a. Failed flow transmitters including bellows rupture
- b. Gas in transmitter sensing lines
- c. Damaged sensing lines
- d. Vibration-induced flow sensor anomalies

3) Electronic Problems

- a. Transmitter failure
- b. Cable failures/problems
- c. Power supply problems
- d. Bus problems/grounds
- e. Induced signals

With respect to each of these conditions the following actions were taken/observation were made:

1) Actual Low Flow Condition:

- a. The primary water inlet throttle valve was fully stroked and corresponding system flow changes were observed in both the open and closed directions. Based on the above and the fact that stator primary water flow existed during and after the trip, it is concluded that the valve did not fail.

b. Review of primary water pump operating data (pressure and vibration) before the trip did not disclose any problems. Additionally, at the time of the trip, other portions of the primary water system supplied flow by the primary water pump did not display flow losses indicative of a pump failure. It is concluded that primary water pump failure was not the cause of the indicated low flow condition.

TEXT PAGE 5 OF 8

c. Flow indication during coast down and review of stator differential pressure data confirmed no flow blockage in the stator cooling circuit.

d. Primary water head tank was checked after the trip, and was found to be stable at expected values indicating no substantial loss of fluid inventory.

2) Indicated Low Flow Condition:

a. Calibration checks performed on the transmitters yielded satisfactory results, indicating no fluid side transmitter failure.

b. Following the trip a number of actions were taken to determine if gas bubbles existed or were likely to have existed at the time of the trip. Gas bubbles in the common orifice and sensing lines for both channels of stator flow could cause spurious signals on both channels needed for 2 of 2 coincident trip signal.

1. Ultrasonic testing of the lines was performed. This testing disclosed no evidence of gas bubbles.

2. The routing of the sensing lines was checked. Some "negative" Sloping was observed due to line sag. This could facilitate accumulation of gas pockets in the lines. Although the ultrasonic testing did not disclose presence of gas in the system, the line routing was altered to achieve a positive slope throughout (prior to restart) to reduce the possibility of gas accumulation in the sensing lines in the future.

3. The lines were refilled prior to restart.

4. Portions of the lines are heat traced. The possibility exists that when the heat tracing is energized dissolved gases could be driven out of solution causing changes in differential pressure and consequently indicated flow. In an effort at determining whether this occurred, the heat tracing was energized and transmitter output was monitored. No change in transmitter output was observed. However, system conditions are different with the generator off line, than when on line. Heat tracing on the sensing lines will remain deenergized when the turbine generator is in operation and should be energized only during cold weather, with the turbine generator off line.

TEXT PAGE 6 OF 8

5. Discussions with the turbine generator vendor, indicated that other plants have experienced gas bubbles in their sensing lines and that a number of actions can be taken to control this problem including; ensuring "positive" line slope; ensuring the lines are properly filled; minimizing the length of the tubing runs between the transmitters and the measuring orifices in the primary water line; and venting the main primary water line at the high point vent.

6. Current practice is to fill the sensing lines with hydrogen saturated water from the primary water system. The use of deaerated demineralized water would provide added assurance of not forming gas bubbles in the sensing lines. The sensing lines were back filled with deaerated demineralized water.

c. Following the trip, a walkdown of accessible portions of the system was performed. No damaged sensing lines were observed.

d. Following the trip a walkdown of the system disclosed no excessive vibration which would contribute to an indicated low flow condition. Additional walkdowns were performed during turbine-generator startup confirmed that excessive vibration does not exist.

3) Electronic Problems

- a. Calibration checks performed on the transmitters yielded satisfactory results, indicating no fluid side transmitter failure. It was concluded that a fluid side transmitter failure did not occur.
- b. System grounds were not received at the time of, or following the trip. It was concluded that cable failures did not exist.
- c. Data was taken on the power supplies which confirmed their nominal voltage and stable operation. It was concluded that power supply problems did not exist.
- d. System grounds were not received at the time of, or following the trip. It is concluded that bus problems/grounds did not exist.

TEXT PAGE 7 OF 8

- e. The transmitters and the system have been previously shown to be unaffected by portable radio (transmitter) operation (reference TU Electric LER 445/94-001-00). Inquiries following the trip could not identify any radio or other temporary/portable electrical equipment usage at the time of the trip. Repeated cycling of the power to heat tracing had no effect on system operation or indication. Checks performed on the failure indicator card in the circuit demonstrated that it was functioning normally, and that it would contribute to the trip condition if functioning normally. System grounds were not received at the time of, or following the trip. It was concluded that induced signals did not cause this event.

A precise cause for the indicated low stator primary water flow could not be determined. Based on the need for 2 of 2 coincidence, the lack of electronic problems, and the fact that the transmitters share common sensing lines, it is believed that the trip was caused by a sensing line hydraulic anomaly, most likely gas bubbles. Further, it is believed that the likelihood of a recurrence has been reduced by the establishment of "positive" slope throughout the run of the sensing lines, and the fact that transmitter signals were unaffected by radio frequency interference and by the cycling of power to the transmitter.

System performance will be monitored until the next refuelling outage for evidence of anomalous behavior in the transmitters and power supplies. TU Electric has scheduled a design modification to install separate primary water stator flow sensing lines, and to install alarms to warn the operators of impending problems.

V. PREVIOUS SIMILAR EVENTS

Licensee Event Report (LER) 50-445/94-001-00 for CPSES Unit 1 reported a low flow condition on primary water to the main generator stator, which was deemed to be caused by a spurious electronic signal.

On February 1, 1994, CPSES Unit 1 experienced a Turbine Trip/Reactor Trip following the receipt of an indication that main generator primary water stator flow was low (50-445/94-001-00). Troubleshooting efforts were immediately initiated to determine the root cause of this event. These efforts revealed that there was no actual loss of primary water flow to the generator. Furthermore, a precise cause for the indicated low primary water stator flow could not be determined. The most probable cause of this trip was determined to be a spurious signal in the instrument loop leading to the

TEXT PAGE 8 OF 8

generation of a trip signal. Long term and short term corrective actions were issued as a result of this event.

Short term corrective action was to monitor key points for power supply and instrument signal stability. This activity was conducted from February 1994, through April 1994. No problems were identified with power supply or instrument signal stability.

Long term corrective actions were: 1) Determine if common mode failure may occur in logic circuitry and 2) Determine feasibility of introducing time delays in logic circuitry to prevent unwarranted trips due to spurious signals. Both long term corrective actions were incorporated into the Trip Reduction Study. This study was completed in September 1994. On September 14, 1994, request for design modifications for Unit 1 and Unit 2 were initiated to implement the design changes recommended in the Siemens Trip Reduction Report. Each design modification proposed eight design changes. These changes included installing separate sensing lines in

the primary water flow stator circuit. These design modifications have not been implemented and were currently pending TU Electric management approval, with implementation projected for 1RF05 (1996).

ATTACHMENT TO 9501050235 PAGE 1 OF 1

Log # TXX-94334
File # 10200
Ref. # 10CFR50.73(a)(2)(iv)

TU ELECTRIC

December 29, 1994

C. Lance Terry
Group Vice President

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: COMANCHE PEAK STEAM ELECTRIC STATION (CPSES) - UNIT 1
DOCKET NO. 50-445
MANUAL OR AUTOMATIC ACTUATION OF ANY ENGINEERED SAFETY
FEATURE
LICENSEE EVENT REPORT 445/94-006-00

Gentlemen:

Enclosed is Licensee Event Report (LER) 94-006-00 for Comanche Peak Steam Electric Station Unit 1, "Turbine Trip/Reactor Trip due to Low Cooling Water Stator Flow Indication."

Sincerely,

C. L. Terry

OB:tg
ENCLOSURE

cc: Mr. L. J. Callan, Region IV
Mr. D. D. Chamberlain, Region IV
Resident Inspectors, CPSES

P.O. Box 1002 Glen Rose, Texas 76043

*** END OF DOCUMENT ***
